**REMARKS**

Claims 12-20, 22-26, and 29 are pending and under rejection; claims 1-11, 21, and 27-28 are canceled.

*Claim Rejections - 35 U.S.C. § 103*

Claims 12-20 are directed to filter devices and stand rejected for obviousness over U.S. Patent No. 5,690,161 (Daussan) in view of U.S. Patent No. 5,785,851 (Morris), U.S. Publication No. 2007/0090047 (Bell), and U.S. Patent No. 4,265,659 (Blome). Claims 22-26 and 29 are directed to methods of making filter devices and stand rejected as obvious over Bell in view of Daussan, Morris, and Blome. For the reasons that follow, applicant respectfully urges that these references as combined do not render the claims as amended *prima facie* obvious, and that these rejections should not be maintained.

The first two factual inquiries of the obviousness analysis under *Graham v. John Deere*, 383 U.S. 1, 17-18 (1966)(and endorsed in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2008)) are: 1) to assess the scope and content of the prior art; and 2) to determine the differences between the claimed invention and the prior art. *See Examinations Guidelines Update: Developments in the Obviousness Inquiry After KSR v. Teleflex*, 75 Fed. Reg. 53643 at 53644 (2010). Further, to establish *prima facie* obviousness of a claim, a rejection must articulate some explanation applicable to the facts at hand of why one of skill would have made the change or combination in the prior art necessary to reach the subject matter of the claim. *2010 KSR Guidelines*, 75 Fed. Reg. at 53645. The present rejections err in both factual inquiries and in articulating a reason for the conclusion of obviousness.

The rejection's assessment of the scope and content of the prior art errs by continuing to rely on subject matter in the Bell '047 Publication that is not prior art to this application. In particular, the present rejections rely on claims 26, 28, and 32 of the '047 Publication to find the claimed graphitized carbon in an amount of 15% by weight and fibers in an amount of up to 10% by weight. This subject matter of these claims does not appear anywhere in the '047 Publication but these claims, but because these claims were added only upon the filing of the application that led to the '047 Publication, they are not entitled to benefit of any of the prior applications to the '047 Publication.

The '047 Publication arose from Application No. 11/584,002, filed October 20, 2006, as a continuation of Application No. 10/362,751 (filed February 26, 2003 and issued as U.S. Patent No. 7,138,084), which in turn claims priority to International Application PCT/GB01/03846 (the '846 PCT, filed August 28, 2001). Claims 26, 28, and 32 of the '047 Publication do not appear in the '846 PCT Application, Application No. 10/362,751, or U.S. Patent No. 7,138,084. These claims were filed for the first time by preliminary amendment on October 20, 2006, copied with other claims from U.S. Patent Publication No. 2005/0229746, for the purpose of provoking an interference with that application.[1]

The public record establishes conclusively that the claims of the '047 Publication cited in the present rejection were never part of the disclosure of the '047 Publication until October 20, 2006. It follows that this subject matter they describe is not entitled to benefit of the '846 PCT filing date and is not prior art under Section 102(e) as to the present claims. These unrebutted (and irrefutable) facts render the present rejections' half-hearted acknowledgement that "it is unclear" if this subject matter is entitled to benefit of the '846 PCT Application disingenuous at best; the Office's continued reliance on these elements of Bell to reject the present claims is manifestly unreasonable and should cease. The scope and content of the prior art relevant to this application does not include any of Bell's disclosures of graphitized carbon and fiber content in the claims filed on October 20, 2006. Given this failure to properly determine the scope and content of the prior art, a flawed assessment of the differences between the claims and the art inevitably followed.

Applicants' independent claims recite a filter device made of a ceramic material comprising up to 20% by weight of fibers and up to 15% by weight of graphitized carbon in a carbon bonded network. The closest disclosure in the prior art to the claimed fiber content is found in Blome, which describes ceramic fiber additions of at least 1% by weight but no more than 5% by weight. Blome further indicates that the 1% lower threshold is necessary to obtain a significant increase in strength, but that more than 5% results in clumping of fibers and poor dispersion in the slurry used to make the filters. Blome, col. 2, line 64 to col. 3, line 5. There is no disclosure in any of the references of a graphitized carbon content of up to 15% by weight. The closest disclosure is found in Bell at [0017] and [0039], where 25% to 50% by weight of a bonding material comprising a carbon matrix is described.

[1] *See* Ser. No. 11/584,002, applicants' remarks in amendments filed October 20, 2006, July 19, 2007, December 7, 2007, June 16, 2008, and December 22, 2008.

The differences between the claims and the prior art therefore are: 1) that the claims require a filter containing up to 20% by weight of fibers, whereas the prior art describes 1% to 5% by weight of fibers; and 2) that the claims require a filter having a graphitized carbon content of up to 15% by weight, whereas the prior art describes 25% to 50% by weight of graphitized carbon. In order to properly reject the claims, the Office must provide some rational explanation for why one of skill would have modified the teachings of Blome and Bell as needed to reach applicants' claims. *Prima facie* obviousness does not exist where the prior art teaches away from a modification proposed in a rejection, where the outcome of the proposed modification is unpredictable, or where one of skill would have had no reasonable expectation that the proposed modification would succeed.

The present rejections fails first because Blome teaches away from a fiber content of up to 20% by weight. As noted previously, Blome describes ceramic fiber additions of at least 1% by weight but no more than 5% by weight. Blome further indicates that the 1% lower threshold is necessary to obtain a significant increase in strength, but that more than 5% results in clumping of fibers and poor dispersion in the slurry used to make the filters. Blome, col. 2, line 64 to col. 3, line 5. Thus Blome would not have led one of skill not to make a filter with up to 20% by weight of fibers, but with no more than 5% by weight of fibers. Further, Blome's admonition that more than 5% by weight of fibers leads to poor dispersion in slurries used to make the filters would have rendered the outcome of using more than 5%, i.e. up to 20%, unpredictable and would have undermined any reasonable expectation by one of ordinary skill that a filter could be made successfully using any amount of fibers above 5%. For this reason alone, one of skill would not have found the subject matter of applicants' claims *prima facie* obvious.

The present rejections also fail because neither the references nor any knowledge in the art generally would have led one of skill to make a filter with up to 15% by weight of a bonded network of graphitized carbon. Bell teaches as low as 25% carbon bonding material, but nothing in Bell, nor in Daussan, Morris, or Blome, would have given one of skill any reason to lower the amount of carbon by at least 40% to reach the level in applicants' claims. In fact, when taken as a whole, the references lead away from the filter of applicants' claims, both in composition and structure.

Daussan describes a process for treating molten metal during a casting operation. For that purpose, Daussan provides a filter comprising two refractory mineral material filtering plates in contact with each other at the periphery and defining between them at least one cavity. Inside that cavity is placed an inorganic treatment material for treating molten metal flowing through the cavity. By this measure all of the metal comes into contact with the treatment agents. In the methods described by Daussan as state of the art there is no guarantee that all of the metal is treated homogeneously. In column 1, lines 31 to 45, Daussan explains that in the methods according to the state of the art the treatment products are contained in destructible sachets which are disposed in a corner of the channels for the metal upstream of the filter. As a disadvantage, the destructible sachets are sometimes dislodged from where they are placed to travel upstream into the funnel into which the molten metal is poured. The gist of the invention described by Daussan therefore is in fixing a treatment material in a stream of molten metal to avoid displacement of the treatment material during metal casting.

The material of the filter is not an important aspect in the description provided by Daussan. The only information Daussan provides regarding the material of the refractory mineral material filtering plates is found in column 4, lines 60 to 64. According to this paragraph these plates are made from a ceramic refractory mineral material such as silica, for example, which are able to withstand the temperature of the cast metal without distortion. In particular, Daussan does not mention use of a ceramic material comprising other materials besides the ceramic material, in particular comprising fibers and a carbon bonded network of graphitized carbon.

The filter claimed in the present application is made of a ceramic material comprising fibers in an amount of up to 20 % by weight of the filter and a carbon bonded network of graphitized carbon, the graphitized carbon constituting the bonded network being present in an amount of up to 15 % by weight of the filter. The advantage of this composite ceramic material is disclosed in paragraphs [0040] to [0046] of the published U.S. application. The filter is cheaper to produce, since firing of the filter can be carried out at low temperature in the range from 500 °C to 1000 °C, and significantly lower superheat is required for the molten metal. An explanation for the reduced requirement for superheat is given in paragraph [0047].

The claimed filter devices also exhibit a low thermal mass. The low thermal mass is attributable to the fact that upon contact between the molten metal and the filter, some extra

heat is produced by burning off a small amount of the carbon bonded network of graphitized carbon. Such extra heat compensates for the heat absorbed from the molten metal upon first contact with the cold filter material, such that freezing of the molten metal and clogging of the filter is avoided.

Daussan suggests an alternative measure to address the problem of providing some extra heat to the molten metal, specifically, the use of a thermogenic treatment material (see column 4, lines 38 to 41). To obtain the thermal mass advantages according to the present invention, a skilled person reading Daussan therefore would select a thermogenic treatment material to produce extra heat and would place the thermogenic material into the cavity provided between two refractory mineral material filtering plates. Daussan therefore clearly teaches away from the claimed filter device and would not have guided a skilled person to the claimed filters.

Combining Daussan and Bell also would not have led the skilled person to a filter as claimed. Bell describes a refractory article that is made by forming a porous article from refractory particles and a carbon rich binder, e.g. tar, pitch, or an organic polymer that degrades to form carbon on pyrolysis, then firing the porous articles to generate the carbon matrix in which the refractory particles are embedded. The amount of binder in the filter is approximately 35-25% according to the closest disclosure to the present claims. Bell describes a reticulated filter as well as filter plates. However, Bell does not describe filters of a complex structure as claimed.

The filter as claimed has a complex structure comprising at least two filter plates with a reservoir chamber situated between the filter plates. In use, molten metal first comes into contact with the upper filter plate, and after having passed the first filter plate, it comes into contact with a second filter plate. Contact with each of the filter plates causes a cooling of the metal. Consequently the risk that the molten metal will freeze as a result of this cooling must be avoided from the time the molten metal first contacts the first filter plate through the time the molten metal, having passed the first filter plate, contacts the second filter plate. The skilled person therefore would expect that significant superheating of the molten metal is necessary to compensate for the cooling of the molten metal on contact with both the first and second filter plates.

The Bell reference describes filters with a reticulated foam structure, which due to its low mass also has a low thermal mass. Such reticulated structures therefore have less impact on the temperature of the molten metal at first contact between molten metal and filter material when compared, e.g., to a massive filter plate. Bell also describes an embodiment wherein pores are provided by a series of parallel ducts passing linearly through the ceramic material; see e.g. paragraphs [0014] and [0021]. However, in the examples only reticulated filters are described. Further, Bell is silent on more complex structures of filters comprising more than one filter plate. In particular, Bell does not address the requirement of superheating of molten metal to avoid freezing of the metal upon first contact between the molten metal and first and second or subsequent filter plates.

According to paragraph [0017] Bell describes relatively high amounts of bonding material, approximately 35 to 25% by weight. Bell does not address the role of the carbon binder as a heat source on first contact of molten metal and binder, and in particular, does not address the present inventors' finding that a very low amount, e.g. up to 15% by weight, of carbon binder is sufficient to obtain this heating effect. Most important, Bell does not provide any information that such heating effect is sufficient also for very complex filter designs, in particular in a filter design as claimed. The skilled person, therefore, would use high amounts of carbon binder in the ceramic material to provide sufficient heat upon contact of the molten metal with first and second filter plate to avoid freezing of the molten metal, consistent with Bell's examples, in which a high amount of carbon binder is used.

Further, Bell suggests several methods for improving stability of the filter by reducing the thermoplastic properties of the carbon material by treating it in one or more stabilization steps before using it as a binder in the production of filters. Exemplary methods are described in paragraphs [0052] to [0054]. In particular, stabilization of the carbon rich material is achieved by heat treatment in the presence of oxygen or by treatment with an acid or an oxidation agent. The skilled person therefore would not use fibers to improve stability of the filter, but instead the skilled person would follow the teaching of Bell and would modify the stabilization treatment of the binder material to thereby achieve a better stability of the filter at high temperature.

But even if a skilled person were to select the claimed combination of a low amount of carbon binder and of fibers, they nevertheless would not have reasonably expected that such a filter would work, because neither the references nor the art generally provide any reason to

conclude that such a low amount of carbon binder as claimed would be sufficient to provide additional heat when molten metal that has already passed the upper filter plate and already has cooled down now comes into first contact with the second filter plate. Without that knowledge the skilled person following Bell clearly would choose higher amounts of carbon binder to provide sufficient heat and then would use stabilization of the carbon material by oxidative treatment as mentioned above when designing a filter of complex shape. Bell therefore clearly teaches away from the claimed filter by guiding the skilled person to use a high amount of carbon rich binder and to stabilize the carbon rich materials to thereby achieve a carbon rich material that is more like a thermosetting material rather than a thermoplastic material.

Together Bell and Daussan would not have led the skilled person to the claimed filter. As already discussed above, when starting from Daussan, the skilled person would have provided a thermogenic material in the reservoir chamber, but would not have selected another ceramic material, in particular a composite ceramic material comprising a carbon bonded network of graphitized carbon. The skilled person therefore would have had no reason to combine Daussan and Bell. When starting from Bell, the skilled person would have selected high amounts of carbon binder to provide sufficient heat upon first contact of molten metal and filter plate as discussed above. In case additional heat would be required, in particular after the metal has passed the first filter plate and comes into contact with the second filter plate in a filter according to Daussan, the skilled person would additionally provide a thermogenic material in the reservoir chamber to avoid superheating of the molten metal as taught by Daussan. Faced with the problem of providing sufficient superheat in a filter of complex shape to avoid freezing of molten metal upon first contact of the molten metal and the second filter plate, e.g. to avoid freezing of the molten metal after the metal has already been cooled by contact with the first filter plate, the combination of Bell and Daussan would not have led one of skilled person to the present inventor's discovery that a low amount of carbon binder is sufficient and that stability of the filter nevertheless is achieved by use of fibers. And while Morris et al. describes a reticulated ceramic filter having an undulating inlet surface, nothing in Morris would have supplemented the deficiencies of Blome, Daussan, and Bell and led one of skill to the combination of low carbon binder concentration and elevated fiber content of the claimed filter.

Lastly, Blome would have led one of skill away from adding a carbon binder material to a filter material at all. Blome describes a ceramic foam material for filtering molten metal which is characterized by improved strength reliability. The filters are prepared by impregnating an organic foam material with an aqueous ceramic slurry containing ceramic fibers. Regarding preparation of the filter Blome refers to U.S. Patent No. 3,893,917. In both Blome and the '917 Patent filters are prepared from aqueous ceramic slurries of water and ceramic materials containing no graphitizable carbon bonding precursor. The filters are sintered at high temperatures of from 1200 °C to 1600°C. After firing, the ceramic fibers protrude out of the walls of the fused ceramics, providing a fuzzy surface on the pores of the filter, which tend to improve filtration efficiency.

Blome explains in column 1, lines 26 to 32, that filtering molten metal in general, and molten aluminum in particular, creates special problems because the liquid is so aggressive that it is difficult to find a filter medium capable of withstanding it. Blome provides a solution to this problem with a filter that comprises only ceramic materials and fibers. The claimed filter comprises a carbon bonded network of graphitized carbon in an amount of up to 15% by weight of the filter. Blome clearly teaches away from such a filter, since Blome explicitly explains the aggressive nature of molten metal, which needs a filter medium capable withstanding it. According to Blome a skilled person would avoid using a carbon bonded network of graphitized carbon in the filter material, and instead would use a filter device made only of ceramic material and fibers to achieve improved stability and improved filtration efficiency due to ceramic fibers protruding out of the walls of the fused ceramic.

For all of these reasons, claims 12-20 are not obviousness over Daussan in view of Morris, Bell, and Blome, nor are claims 22-26 and 29 obvious over Bell in view of Daussan, Morris, and Blome.

**Conclusion**

In view of the arguments above, applicant respectfully requests reconsideration and allowance of the claims.

Respectfully submitted,

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